Remarks

Rejections Under 35 USC §102 and 35 USC §103

Claims 34-35 have been rejected under 35 USC §102 as being anticipated by Grube et al. (US Patent No. 5,525,545).

Claims 38-41, 43 and 49-51 have been rejected under 35 USC §103(a) as being unpatentable over Grube et al. (US Patent No. 5,525,545) in view of Banba et al. (US Patent No. 6,406,774) and Fjelstad et al. (US Patent No. 5,632,631).

The rejections under 35 USC §102 and 35 USC §103 are traversed for the reasons to follow. In the alternative the rejections under 35 USC §102 and 35 USC §103 have been overcome by the amendments to the claims.

Rejection Of Claims 34-35 Under 35 USC §102

Claims 34 and 35 are directed to a "method for fabricating an interconnect 10 (Figure 1) for a semiconductor component 18 (Figure 2C) having a bumped contact 16 (Figure 2C)". The method is shown in Figures 7A-7G. As shown in Figure 7A, an insulating layer 24B and a metal layer 54B are formed on a substrate 14B. As shown in Figures 7B and 7C, leads 22B having blades 28A thereon are formed using the metal layer 54B. As shown in Figure 7H, the leads 22B include a connecting segment 40B. As shown in Figure 7F, a recess 20B is formed in the substrate such that the leads 22B are cantilevered over the recess 20B. As shown in Figure 7F, a conductive via 42B is formed in the substrate 14B in electrical communication with the connecting segment 40B, and a contact 38B is formed on an opposing side of the substrate 14B.

The 35 USC §102 rejections over Grube et al. are traversed, as the reference does not anticipate all of the limitations of amended independent claim 34. In this regard, a proper 35 USC §102 rejection requires that each

and every limitation of the claimed invention be disclosed in a single prior art reference. In addition, the reference must be enabling and describe the applicant's claimed invention sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention. In re David C. Paulsen, 30 F.3d 1475, 31 USPQ 2d (BNA) 1671, (U.S. App 1994).

Amended independent claim 34 recites the step of providing a substrate having a surface and an opposing surface. Both surfaces are shown in Figure 7A. Antecedent basis for the term "opposing surface" is contained on page 5, line 9, of the specification.

Amended independent claim 34 also recites the step of "forming a plurality of leads on the surface configured to electrically engage and support the bumped contact and a connecting segment on the surface configured to electrically connect the leads to one another". The leads 22B and the connecting segment 40B are shown in Figure 7I. In addition, the above recitation is not merely a statement of intended use, but rather recites the step of forming a physical structure configured to perform the stated function of electrically engaging and supporting a bumped contact. As held in In re Caldwell, 138 USPQ 243 (CCPA 1963), functional limitations in a method claim can be used for "particularly pointing out and distinctly claiming the invention".

Admittedly, Grube et al. discloses projection sections 537 (Figure 11) connected by a loop section 536 that could be considered equivalent to leads with a connecting segment. However, there is no teaching in Grube et al. that these elements are formed, or can inherently function, in the same manner as the leads of the present method. Rather, as described at column 19, lines 9-42 and shown in Figure 12 of Grube et al., the tips 549 of the projection sections 537 are designed to wipe against contact pads 584 on a substrate 582 (column 19, lines 39-41). As also shown

in Figure 12 of Grube et al., a column 552 of an encapsulant 520 (column 18, lines 62-64) is placed between the projection sections 537. However, there is no teaching or enablement of the concept of forming the projection sections 537 to support and electrically engage a bumped contact, as with amended independent claim 34. Further, the projection sections 537 could not support and electrically engage a bumped contact because the encapsulant 520 would be in the way.

Amended independent claim 34 also recites the step of "forming a recess in the surface such that the leads cantilever over the recess and are configured for movement within the recess during electrical engagement of the bumped contact". Although Figure 10D of Grube et al. discloses a finger 412 cantilevered over an opening 420, there is no indication or enablement in Grube et al. of the concept of forming the opening 420 so that the finger 412 can move within the opening 420 during electrical engagement of a bumped contact. As argued above the opening is designed for use with an encapsulant that forces the finger 412 against a contact pad 584 and the encapsulant would prevent a bumped contact from moving into the opening.

Amended independent claim 34 also recites the steps of "forming a conductive via in the substrate in electrical communication with the connecting segment", and "forming a contact on the opposing surface in electrical communication with the conductive via". The conductive via 42B and the contact on the opposing surface (contact pad 38B) are shown in Figure 7E. These steps provide an improved interconnect because electrical engagement from the outside world can be to the opposing surface (i.e., the backside) of the interconnect. In addition, the pitch of the contacts on the opposing surface (i.e., pitch of contact pads 38B in Figure 7F) can be different than the pitch of the interconnect contacts 14B (Figure 7G).

Grube et al. does not disclose either of the above steps, such that amended independent claim 34 "taken as a whole" is submitted to be unobvious over Grube et al. In this regard, although conductive vias are known in the art, the present method forms the conductive vias in combination with cantilevered leads and a connecting segment. The resultant structure can support a bumped contact while providing an outside contact system to the backside of the interconnect.

Rejection Of Claims 38-41, 43 and 49-51 Under 35 USC §103

The 35 USC §103 rejections over Grube et al. in view of Banba et al. and Fjelstad et al. are traversed as the cited combination does not disclose all of the present claim limitations, as required by MPEP 2142, 2143.

Amended independent claims 39 and 49 recite essentially the same steps as amended independent claim 34. Accordingly claims 39 and 49 include limitations, which as argued above with respect to the 35 USC §102 rejections, are not disclosed by Grube et al.

In support of the 35 USC §103 rejections, Banba et al. was cited as teaching "forming a conductive via by laser machining". Fjelstad et al. was cited as teaching "forming a plurality of projections (32) in the metal layer".

However, independent claim 38 also recites the steps of "forming an opening through the substrate and the connecting segment", and "forming a conductive material in the opening". The opening 64B is shown in Figure 7D, and the conductive material 66B is shown in Figure 7E. Although conductive vias are known in the art, the present method forms conductive vias by forming an opening in a connecting segment for leads cantilevered on a recess. Amended independent claim 38 "taken as a whole" is thus submitted to be unobvious over the prior art.

Amended independent claim 49 recites the steps of "forming a plurality of conductive vias in the substrate in

electrical communication with the interconnect contacts", and "forming a plurality of contacts on the opposing surface having a different pitch than that of the interconnect contacts." The contacts are the contact pads 38B shown in Figure 7E, and antecedent basis for the different pitch recitation is contained on page 5, lines 10-13 of the specification. As previously argued, these steps allow contact to be made from the outside to the back side (i.e., opposing side) of the interconnect. Although conductive vias are known in the art, the present method forms conductive vias in combination with cantilevered leads and back side contacts. Amended independent claim 49 "taken as a whole" is thus submitted to be unobvious over the prior art.

With respect to the limitation of forming blades on the leads, admittedly penetrating structures are known in the art. However, the present penetrating structure, in combination with cantilevered leads and conductive vias, is submitted to be unobvious over the prior art.

Applicant would further argue that one skilled in the art at the time of the art would have no incentive to combine Grube et al. and Banba et al. In support of the combination the Office Action states at paragraph 4: "It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify Grube by forming a conductive via by laser machining in the substrate and partially filling the via with a conductive material as taught by Banba, for the purpose of providing electrical communication with the connecting segment and the leads".

However, the above statement is incorrect, as the connecting segment and the leads in Grube et al. are already in electrical communication, and a conductive via is not required for this purpose. Rather, the purpose of the conductive via in the present method is to provide electrical communication between the connecting segment and

the contacts on the opposing side (back side) of the interconnect. Further, one skilled in the art at the time of the invention would have no incentive to use a conductive via forming step based on the teachings of Grube et al. or Banba et al., because electrical communication is already established in Grube et al. by the bonding portions 50 in Figure 1.

Objection To Withdrawal of Claims 52-58

The withdrawal of claims 52-58 is again traversed as all of these claims are directed to the elected species (Species VII-Figures 7A-7I). In this regard independent claim 53 recites essentially the same steps as independent claims 34, 39 and 49 but also adds the "lead shaping" step shown in Figure 7G. This is not a different species but is the same species with an additional step.

In support of the restriction requirement, the Office Action of October 8, 2002 states at paragraph 5: "Examiner disagrees with the restriction argument. Please see last Office Action."

Referring to the Office Action of March 29, 2002, it states at paragraph 1: "To the contrary, claims 42 and 52-58 are drawn to Species relating to Figs. 2D or 3B. Therefore, claims 42 and 52-58 are withdrawn from further consideration, along with claims 36-37 and 44-48."

However, the Office Action of October 18, 2001 identified Species VII as Figures 7A-7I. The elected species includes a lead shaping step which is shown in Figure 7G. If the Examiner intended to classify Figure 7G as a separate species, this should have been stated in the original species election requirement. Further, Figure 2D does not disclose a lead shaping step as stated by the Examiner, but rather shows the leads being bent by the bumped contact 16. In addition, Figure 3B does not show a lead shaping step, but rather shows leads 22B that have been shaped using the elected species of Figures 7A-7I. In

this regard see Figure 7G wherein the leads 22B are being shaped.

Conclusion

In view of the above arguments and amendments, favorable consideration and allowance of claims 34-35, 38-43 and 49-58 is respectfully requested. Should any issues arise that will advance this case to allowance, the Examiner is asked to contact the undersigned by telephone.

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December 5, 2002
Date of Signature

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MARKED VERSION SHOWING CHANGES TO AMENDED CLAIMS

34. (thrice amended) A method for fabricating an interconnect for a semiconductor component having a bumped contact comprising:

providing a substrate having a surface and an opposing surface;

forming a plurality of leads on the [substrate] surface configured to electrically engage and support the bumped contact and a connecting segment on the surface configured to electrically connect the leads to one another;

[, each lead having a length, a width, a thickness and a modulus of elasticity selected to provide a desired spring constant; and]

forming a recess in the surface [substrate proximate to the leads] such that the leads cantilever over the recess and are configured [to support the bumped contact and to move] for movement within the recess during electrical engagement of the bumped contact;

forming a conductive via in the substrate in electrical communication with the connecting segment; and

forming a contact on the opposing surface in electrical communication with the conductive via.

35. (thrice amended) The method of claim 34 wherein the forming the conductive via step comprises forming an opening through the connecting segment and the substrate and forming a conductive material in the opening.

[plurality of leads step comprises forming a metal layer on the substrate and then etching the metal layer.]

38. (thrice amended) The method of claim 34 further comprising forming blades on the leads configured to penetrate the bumped contact.
[forming a connecting segment on the substrate for the leads and a conductive via in the substrate in electrical communication with the connecting segment.]

39. (thrice amended) A method for fabricating an interconnect for a semiconductor component having a bumped contact comprising:

providing a substrate having a surface and an opposing surface;

forming a plurality of leads on the surface configured to electrically engage and support the bumped contact and a connecting segment on the surface configured to electrically connect the leads to one another;
[metal layer on the substrate;]

[etching the metal layer to form a plurality of leads and a connecting segment electrically connecting the leads;]

[etching] forming a recess in the [substrate] surface such that the leads are cantilevered over the recess and [movable within the recess to electrically engage] are configured to move within the recess during electrical engagement of the bumped contact;
[, each lead having a cantilever length, a width, a thickness and a modulus of elasticity selected to provide a desired spring constant; and]

forming [a conductive via] an opening through [in] the substrate [in electrical communication with] and the connecting segment;

forming a conductive material in the opening; and

forming a contact on the opposing surface in electrical communication with the conductive material.

40. (thrice amended) The method of claim 39 wherein the forming the opening step comprises laser machining.
[further comprising forming a plurality of projections in the metal layer such that each lead comprises at least one projection.]

41. (thrice amended) The method of claim 39 wherein the recess is generally square having four sides and the leads extend generally orthogonally to the four sides.
[forming the conductive via step comprises laser machining an opening through the connecting segment and the substrate and at least partially filling the opening with a conductive material.]

42. (twice amended) The method of claim 39 further comprising shaping the leads with a radius of curvature corresponding to a diameter of the bumped contact.

43. (thrice amended) The method of claim 39 further comprising forming a plurality of blades on the leads configured to penetrate the bumped contact.
[contact pad on the substrate in electrical communication with the connecting segment and the conductive via.]

49. (twice amended) A method for fabricating an interconnect for a semiconductor component having a plurality of bumped contacts comprising:

providing a substrate having a surface and an opposing surface;

forming a plurality of interconnect contacts on the substrate configured to electrically engage the bumped contacts, each interconnect contact comprising a recess in the surface and a plurality of leads cantilevered over the recess configured to support a bumped contact for movement in the recess;

forming a plurality of conductive vias in the substrate in electrical communication with the interconnect contacts; and

forming a plurality of contacts on the opposing surface having a different pitch than that of the interconnect contacts.

[metal layer on the substrate;]

[etching the metal layer to form a plurality of leads configured to electrically engage the bumped contact and a connecting segment electrically connecting the leads;]

[forming a recess in the substrate proximate to the leads such that the leads are cantilevered over the recess and movable within the recess to electrically engage the bumped contact;]

[laser machining an opening through the connecting segment and the substrate; and]

[depositing a conductive material in the opening to form a conductive via in electrical communication with the connecting segment.]

50. (twice amended) The method of claim 49 wherein the contacts comprise pads.

[further comprising forming a contact on the substrate in electrical communication with the conductive material.]

51. (twice amended) The method of claim 49 further comprising forming a plurality of blades on the leads configured to penetrate the bumped contact.

[an electrically insulating layer on the opening prior to the depositing the conductive material step.]

52. (twice amended) The method of claim 49 wherein the forming the conductive vias step comprises laser machining.

[further comprising shaping the leads with a radius of curvature corresponding to a diameter of the bumped contact.]

53. (amended) A method for fabricating an interconnect for a semiconductor component having a bumped contact comprising:

providing a substrate having a surface and an opposing surface;

forming a plurality of leads on the [substrate] surface configured to electrically engage the bumped contact;

forming a connecting segment on the surface electrically connecting the leads;

forming a recess in the [substrate proximate to the leads such that] surface with the leads cantilevered over the recess and [are] configured to support the bumped contact [and to move] for movement within the recess; [and]

shaping the leads with a radius of curvature corresponding to a diameter of the bumped contact;

forming a conductive via in the substrate in electrical communication with the connecting segment; and

forming a contact on the opposing surface in electrical communication with the bumped contacts.

54. (amended) The method of claim 53 further comprising forming a plurality of blades on the leads configured to penetrate the bumped contact.
[connecting segment electrically connecting the leads and forming a conductive via through the substrate in electrical communication with the connecting segment.]

55. (amended) The method of claim [54] 53 wherein the forming the conductive via step comprises laser machining an opening through the connecting segment and the substrate.

56. (amended) The method of claim 53 wherein the contact comprises a pad.
[55 wherein the forming the conductive via step comprises at least partially filling the opening with a conductive material.]

57. (amended) The method of claim [56] 53 wherein the forming the conductive via step comprises electrically insulating and then at least partially filling an [the] opening with a conductive material.

58. (amended) The method of claim [57] 53 wherein the substrate comprises a material selected from the group consisting of silicon, ceramic and plastic.